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| EXAMINER | |
|---|---|
| MCNELIS, KATHLEEN A | |

| ART UNIT | PAPER NUMBER |
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| 1742 | |

| SHORTENED STATUTORY PERIOD OF RESPONSE | MAIL DATE | DELIVERY MODE |
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**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

| Office Action Summary | Application No. | Applicant(s) |
|---|---|---|
| | 10/541,457 | SUGITATSU ET AL. |
| | Examiner | Art Unit |
| | Kathleen A. McNelis | 1742 |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *31 October 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1 and 3-11* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1 and 3-11* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

## Claims Status

Claims 1 and 3-11 remain for examination wherein claim 1 is amended and claims 8-11 are new.

## Status of Previous Rejections

The following rejections are withdrawn in view of claim amendments:

- Claims 1, 3, 4 and 7 under 35 U.S.C. 102(b) as anticipated by Kundrat (U.S. Pat. No. 5,567,224);
- Claims 1 and 3-7 under 35 U.S.C. 102(b) as anticipated by Kikuchi et al. (U.S. Pat. No. 6,592,649);
- Claims 1 and 7 under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Ibaraki et al. (U.S. Pat. No. 6,755,888) alone or in view of Takeda et al. (U.S. Pat. No. 6,270,552); and
- Claim 2 is rejected under 35 U.S.C. 102(b) as anticipated[1] by Kundrat (U.S. Pat. No. 5,567,224) or Kikuchi et al. or Ibaraki et al. (U.S. Pat. No. 6,755,888) alone or in view of Takeda et al. (U.S. Pat. No. 6,270,552) and further in view of Meissner et al. (5,730,775) and Perry's Chemical Engineers' Handbook.

## Examiner's Comments

Claim 1 was amended to incorporate now cancelled claim 2. The grounds for rejection of amended claim 1 is the same as applied to claim 2 in the 06/23/2006 Office action, however it is repeated below for clarity since this grounds is now applied to new claims 8-11 as well. The grounds for rejection of claims 3-7 are repeated from the 06/23/2006 Office action.

## DETAILED ACTION

### *Claim Rejections - 35 USC § 103*

[1] As noted in 10/31/2006, statutory basis for this rejection should have read under 35 U.S.C. 103(a) as obvious over.

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 1, 7 and 9-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kundrat (U.S. Pat. No. 5,567,224), or Kikuchi et al. (U.S. Pat. No. 6,592,649), or Ibaraki et al. (U.S. Pat. No. 6,755,888) alone or in view of Takeda et al. (U.S. Pat. No. 6,270,552) in view of Meissner et al. (5,730,775) and Perry's Chemical Engineers' Handbook.

With respect to claim 1:

Kundrat discloses a method for reducing metal oxide in a rotary hearth furnace wherein a mixture of metal oxide and carbonaceous reducing agent is placed on the upper surface of the hearth and the metal oxide may be chrome ore, chromium ore concentrate or stainless steel flue dust (abstract). Kundrat teaches that the mixture of metal oxide and reductant is placed in a layer upon the hearth and heated to a temperature of at least 1000 °C more preferably at least 1200 °C before a second layer of carbonaceous reductant is placed over the mixture. The reason for heating the mixture first is that the second layer can be insulating, causing ineffectual heating of the mixture in the rotary furnace (col. 4 lines 19-40). Kundrat discloses that the layer of mixture should be no greater than 40 mm and preferably less to minimize the time required for heating the mixture (col. 8 lines 38-65), which examiner contends will result in rapid heating. Kundrat teaches that the heating is by radiation (col. 8 lines 1-26).

Kikuchi et al. discloses a method for reducing a mixture of an iron oxide containing raw material with a carbonaceous reducing agent such as coke (abstract) where the iron oxide source material includes chromium oxide in addition to iron oxide (col. 11 lines 34-53). Kikuchi et al. discloses two heating steps including solid reduction which is done preferably at a temperature of between 1200 to 1400 °C and then the temperature is raised to between 1400 to 1500 °C to melt

and coalesce the metallic iron nuggets (col. 7 lines 38-53). The examples teach that a rotary hearth type furnace is charged with about a 20 mm thickness of a mixture of iron ore and carbonaceous reducing agent, then the temperature is rapidly raised to 1100 °C (col. 13 line 42 – col. 14 line 5).

Ibaraki et al. discloses a method of reducing metal oxides in a rotary hearth type furnace (abstract) where a carbon containing powder is mixed with powders of iron and chromium ore as well as waste products from iron and steel production (col. 7 lines 14-30). The mixture is pelletized and fed to a hearth of a rotary hearth furnace where the pellets are spread across the hearth and quickly heated at temperatures of 1100 to 1300 °C where iron reduction reaches 95% or higher and chromium reduction reaches 50% or higher (col. 1 line 59 – col. 2 line 16).

Although Ibaraki et al. does not teach that the heating is by radiation as in instant claim 1, examiner contends that this would be the case in a moving hearth furnace and in the absence of evidence to the contrary.

Kundrat or Kikuchi et al. or Ibaraki et al. alone does not disclose that the average rate of raising the temperature of the mixture in the reducing step is 13.6 °C/min or higher from the initiation of the radiation until the mixture reaches 1,114 °C.

Meissner et al. discloses a method for producing direct reduced iron from dry compacts of iron oxide and carbonaceous material (abstract). Compacts are exposed to a radiant heat source in a rotary hearth furnace preheating zone (col. 1 lines 10-15). Results presented by Meissner et al. demonstrate that the higher the temperature of the radiant heat source, the faster the compacts reach metallization goals (col. 5 lines 1-13). While Meissner et al. does not equate the higher temperature with increased heating rate, one of ordinary skill in the art would recognize that the rate of radiant heat transfer in a furnace is strongly affected by temperature ($T^4$) as taught by

Perry's Chemical Engineer's Handbook (p. 5-23 to 5-32). Meissner et al. therefore demonstrates that the temperature of the radiant heat transfer source is a result effective variable which is varied to affect the time required to achieve metallization goals and Perry's Chemical Engineer's Handbook teaches that increasing the temperature of the radiant heat source increases the heating rate as a function of $T^4$. It would have been obvious to one of ordinary skill in the art at the time the invention was made to adjust the radiant heat source temperature as a result-effective variable in the process of Kundrat or Kikuchi et al. or Ibaraki et al. alone or in view of Takeda et al., therefore adjusting the rate of heating to affect the time required to achieve metallization goals as taught by Meissner et al. (see M.P.E.P 2144.05, II, B).

Alternatively, Ibaraki et al. does not teach that the rapid temperature rise in the mixture is caused by radiation heating.

Takeda et al. discloses a method for reducing a layer consisting of a mixture of oxides such as iron ore and solid reducing material in a rotary traveling hearth and reducing the oxides through radiant heat transfer from above the hearth (abstract). Takeda et al. teaches that in a rotary furnace, the furnace hearth and body are lined with refractory and burner(s) act as a heat source in the upper part of the furnace reducing the solids on the lower hearth portion by radiation heating (col. 1 line 21 – col. 2 line 31). One of ordinary skill in the art would therefore expect at least one heat transfer mechanism in Ibaraki et al. to be radiant heat, since the process is as disclosed by Takeda et al. wherein the heat transfer mechanism is radiant heating.

With respect to <u>claim 7</u>:

a. Kundrat discloses that carbonaceous powder is charged to the furnace (col. 4 lines 19-40), which examiner contends is a carbonaceous atmosphere-adjusting agent; or

b. Kikuchi et al. discloses that carbonaceous material is charged as discussed above regarding claim 1; or
c. Ibaraki et al. discloses that carbon powder is charged to the furnace (col. 7 lines 14-30), which examiner contends is a carbonaceous atmosphere-adjusting agent.

With respect to claim 9, Kundrat or Kikuchi et al. or Ibaraki et al. discloses a mixture of chromium oxide, iron oxide and carbonaceous reductant as discussed above regarding claim 1. The reducing is performed by rapid temperature rise in a moving hearth furnace as discussed above regarding claim 1. While Kundrat or Kikuchi et al. or Ibaraki et al. does not recite that the Cr reduction proceeds according to the relationship $R_{Cr}(\%) = A(1\text{-}\exp(-t/\tau))+k$, such would be expected since the process disclosed by Kundrat or Kikuchi et al. or Ibaraki et al. alone or in view of Takeda et al. and in further view of Meissner et al. and Perry's Chemical Engineers' Handbook is essentially the same as the instant invention. Further, since $\tau$ is a constant with no recited quantitative limit in claim 9, the residence times of between $1\tau$ and $8\tau$ are met by Kundrat or Kikuchi et al. or Ibaraki et al. alone or in view of Takeda et al. and in further view of Meissner et al. and Perry's Chemical Engineers' Handbook.

With respect to claim 10, Kundrat or Kikuchi et al. or Ibaraki et al. discloses a mixture of chromium oxide, iron oxide and carbonaceous reductant as discussed above regarding claim 1. The reducing is performed by rapid temperature rise in a moving hearth furnace as discussed above regarding claim 1. Regarding the residence times:

a. Knudrat discloses that the residence time at 1350 °C should be at least 30 minutes (col. 7 lines 1-10), which overlaps the claimed range of 5.3 to 42.7 minutes. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use a residence time of between 30 and 42.7 minutes, since Kundrat teaches equal utility at above 30 minutes, therefore a prima facie case of obviousness exists (see M.P.E.P § 2144.05).

b. Kikuchi et al. discloses a residence time of 10 to 13 minutes for reduction, melting or coalescing (col. 7 lines 38-53), therefore the reduction time is within, overlapping, or close enough to between 5.3 and 42.7 minutes that one of ordinary skill in the art would expect the same results (seeM.P.E.P § 2144.05).

c. Ibaraki et al. discloses reducing from between 5 to 20 minutes (col. 2 lines 1-16), which overlaps the claimed range of 5.3 to 42.7 minutes, therefore a prima facie case of obviousness exists.

With respect to claim 11, Kundrat or Kikuchi et al. or Ibaraki et al. discloses a mixture of chromium oxide, iron oxide and carbonaceous reductant as discussed above regarding claim 1. The reducing is performed by rapid temperature rise in a moving hearth furnace as discussed above regarding claim 1. While Kundrat or Kikuchi et al. or Ibaraki et al. does not recite that the Fe metallization degree does not reach 50% prior to the mixture having reached a temperature of 1,114 °C, such would be expected since the process disclosed by Kundrat or Kikuchi et al. or Ibaraki et al. alone or in view of Takeda et al. and in further view of Meissner et al. and Perry's Chemical Engineers' Handbook is essentially the same as the instant invention.

Claims 3, 4 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kundrat (U.S. Pat. No. 5,567,224) or Kikuchi et al. (U.S. Pat. No. 6,592,649) in view of Meissner et al. (5,730,775) and Perry's Chemical Engineers' Handbook as applied to claim 1.

Kundrat or Kikuchi et al. in view of Meissner et al. and Perry's Chemical Engineers' Handbook is applied as discussed above regarding claim 1.

With respect to claims 3 and 8:

a. Kundrat teaches reducing at 1350 °C (col. 6 lines 50-55) which anticipates the claimed range of from 1250 to 1400 °C (claim 3) or 1300 to 1400 °C (claim 8), or

b. Kikuchi et al. example 1 discloses that the reduction step is performed at about 1350 °C (col. 13 lines 1-5), which is within the claimed range of from 1250 to 1400 °C or 1300 to 1400 °C (claim 8).

With respect to claim 4:

a. Kundrat teaches further melting of the partially reduced chromite ore in a furnace and/or converter (Fig. 1 (16) and/or (18), col. 7 lines 35-40 and examples 1 and 3), or
b. Kikuchi et al. discloses that the reduced mixture is subsequently melted (col. 14 lines 1-10)

Claims 5 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kikuchi et al. (U.S. Pat. No. 6,592,649) in view of Meissner et al. (5,730,775) and Perry's Chemical Engineers' Handbook as applied to claim 1.

Kikuchi et al. in view of Meissner et al. and Perry's Chemical Engineers' Handbook is applied as discussed above regarding claim 1.

Kikuchi et al discloses that, the reduced mixture is subsequently melted (col. 14 lines 1-10) then cooled and solidified (col. 14 lines 5-17) as in instant claim 5. With respect to claim 6, the temperature for reducing is about 1350 °C which is within the claimed range of from 1250 to 1400 °C, then is raised to about 1400 or 1460 °C for melting (col. 13 lines 1-5) which are within the claimed range of from 1350 to 1700 °C.

***Response to Arguments***

Applicant's arguments filed 10/31/2006 have been fully considered but they are not persuasive.

Applicant's arguments are summarized as follows:

1. The applied prior art Kundrat, Kikuchi et al., Ibaraki et al. and Takeda et al. do not disclose raising the temperature of the mixtures in the reducing step at a particular

minimum speed at which the reduction of Cr starts according to formula 2 on p. 14 of the specification.

2. The initiation of radiant heating is further defined in the specification page 14.
3. Meissner et al. discloses that prior art used reduction at a lower temperature to dry and devolatilize pellets in order to avoid pellet exfoliation, however Meissner et al. discovered that pellets could be put directly into a radiant heat source at tempetures from 1316 to 1427 °C without causing exfoliation, thereby increasing productivity, but has nothing to do with Cr reduction. There would have been no reason to combine Meissner and Perry with the remaining prior art.
4. For claims 3 and 8, the specification compares reduction at 1200 and 1300 °C where Cr reduction degree is significantly higher relative to the Fe metallization degree, a result which could not have been predicted by the prior art.

Examiner's responses are as follows:

1. Kundrat, Kikuchi et al. or Ibaraki et al. alone or in view of Takeda et al. disclose rapid heating as discussed on pp. 3-5 of the 6/23/2006 office action regarding original claim 1 and repeated above regarding amended claim 1. Kundrat, Kikuchi et al. and Ibaraki et al. alone or in view of Takeda et al. do not recite a specific minimum heating speed as acknowledged on pp. 5-6 of the 06/23/2006 Office action regarding original claim 2 and repeated above regarding amended claim 1. However, Meissner et al. and Perry's Chemical Engineer's Handbook are used to show that heating rate is a result effective variable as set forth on p. 6 of the 06/23/2006 Office action regarding original claim 2 and repeated above regarding amended claim 1. Optimization of heating rate would therefore be desired and achievable by one of ordinary skill in the art. Formula (2) on p.

14 of the specification presents the stoichiometric reduction reaction for reduction of chromium by carbonaceous a temperature of at least 1,114 °C (specification, p. 14). Since the applied prior art teaches rapid heating and reduction of chromium oxides in the presence of carbonaceous reductants at temperatures exceeding 1,114 °C, examiner does not agree that this patentably distinguishes above the applied prior art.

2. The specification p. 14 defines:

> "The initiation of the radiation heating of the feedstock mixture" herein refers to the point in time when the feedstock mixture enters a region (radiation heating region) exposed to radiation heating with, for example, a burner in the moving hearth furnace 5. The above period

This requirement has been addressed on pp. 3-5 of the 06/23/2006 Office action and is repeated above. Kundrat, Kikuchi et al. or Ibaraki et al. each disclose introduction of the feedstock to a moving hearth furnace at operating at reduction temperatures. Further evidence that this operating scenario results in radiant heating is provided by Takeda et al. and Meissner et al. as discussed on pp. 5-6 of the 06/23/2006 Office action and repeated above.

3. Kundrat, Kikuchi et al. or Ibaraki et al. disclose reduction of mixtures of iron and chromium oxides with carbonaceous reductant in a rotary hearth furnace as discussed on pp. 3-5 of the 06/23/2006 Office action and repeated above. Meissner et al. disclosed reduction of iron oxide with carbonaceous reductant in a rotary hearth furnace as set forth on p. 6 of the 06/23/2006 Office action and repeated above. Meissner et al. is therefore analogous to Kundrat, Kikuchi et al. and Ibaraki et al. and the teachings are

relevant as all relate to reduction of iron oxide. The motive to combine is set forth on p. 6 of the 06/23/2006 Office action and repeated above. The fact that applicant has recognized another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985).

4. Kundrat or Kikuchi et al. disclose reduction at 1350 °C as discussed on pp. 3-4 of the 06/23/2006 Office action and repeated above, thereby meeting the claim limitiations. The fact that applicant has recognized another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985).

***Conclusion***

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event,

however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kathleen A. McNelis whose telephone number is 571-272-3554. The examiner can normally be reached on M-F 8:00 AM to 4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Roy King can be reached on 571-272-1244. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov.. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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